VERTICICLADIELLA ALACRIS, A SYNONYM OF *V. SERPENS*

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Verticicladiella alacris Wingfield & Marasas was recently described from South Africa as a new pathogenic *Verticicladiella* on *Pinus* spp. (Wingfield & Knox-Davies, 1980; Wingfield & Marasas, 1980). The major characteristics distinguishing *V. alacris* from other *Verticicladiella* spp. (Kendrick, 1962) are the robust fruiting structures and rapid growth rate in culture, form of the rhizoidal hyphae, distinct helicoid mycelium and presence of poorly developed micronematous conidiophores (Wingfield & Marasas, 1980).

This paper compares *V. alacris* (PREM 45483) with *V. serpens* (Goid.) Kendrick (CBS 641.76) isolated from *Pinus taeda* in Italy (Gambogi & Lorenzini, 1977) and the type culture of this species (CBS 141.36). Reference is also made to certain characteristics of the following *Verticicladiella* isolates examined: *V. abietina* (Pk) Hughes (DAOM 37980), *V. antibiotica* Kendrick (DAOM 84388), *V. brachiata* Kendrick (DAOM 34360), *V. penicillata* (Grosm.) Kendrick (DAOM 69631), *V. procera* Kendrick (DAOM 62096) and *V. wageneri* Kendrick (isolate examined by Wingfield & Marasas, 1980).

Kendrick (1962) distinguished *V. serpens* from other *Verticicladiella* spp. by the presence of distinctive side branches on the stipe of the conidiophore which resulted in a generally 'open' construction of the sporogenous apparatus (Kendrick, 1962). Gambogi & Lorenzini (1977), however, noted a simple verticillate sporogenous apparatus on occasionally branched conidiophores in their isolate of *V. serpens* (CBS 641.76).

These authors did not, however, comment on the significance of the conidiophore side branches which Kendrick (1962) described as a major characteristic. Examination of the type culture of *V. serpens* (CBS 141.36) by the present authors showed branching conidiophores (Fig. 1) similar to those described by Kendrick (1962). Side branches of conidiophores were observed in isolate CBS 641.76 also examined by Gambogi & Lorenzini (1977) but were unlike those described by Kendrick (1962). Instead, they resembled conidiophore aberrations reported in *V. alacris* (Wingfield & Marasas, 1980). The branching of the primary metulae described by Kendrick (1962) as unique to *V. serpens* is thought to result from storage of the fungus in culture. The conidiogenous apparatus in *V. serpens* is better described as having an extending apex (Gambogi & Lorenzini, 1977) alternatively called a central primary metula (Wingfield & Marasas, 1980) surrounded by verticils of lateral metulae (Figs 2, 3).

Simple micronematous conidiophores were observed in the type culture of *V. serpens* (CBS 141.36) and isolate CBS 641.76. Similar structures were described in *V. alacris* (Wingfield & Marasas, 1980) but were not reported by Kendrick (1962) or Gambogi & Lorenzini (1977). Micronematous conidiophores have also been reported in *V. procera* (Wingfield & Marasas, 1980) and *V. wageneri* (Kendrick, 1962; Wingfield & Marasas, 1980) but were distinct from those of *V. serpens*.

Kendrick (1962) discounted the importance of the serpentine mycelium of *V. serpens*, a characteristic stressed by Goidanich (1936) and used as the basis for the specific epithet. Gambogi & Lorenzini (1977) made no reference to the mycelium in *V. serpens*. Serpentine hyphae referred to by Goidanich (1936) were poorly developed (Fig. 4) in the type culture (CBS 141.36), which is probably why Kendrick (1962) discounted this character in his description. Serpentine hyphae were, however, present and well developed (Fig. 5) in isolate CBS 641.76 examined by Gambogi & Lorenzini (1977). They were also identical to the so-called helicoid hyphae (Fig. 6) in *V. alacris* (Wingfield & Marasas, 1980). Serpentine hyphae were not observed by the present authors in cultures of *V. abietina*, *V. antibiotica*, *V. brachiata*, *V. penicillata*, or *V. procera*. However, *V. wageneri* had similar undulating hyphae, but these did not fold back on each other in a serpentine manner. These hyphae are more branched than those of *V. serpens* and give rise to well-developed micronematous conidiophores (Kendrick, 1962; Wingfield & Marasas, 1980).

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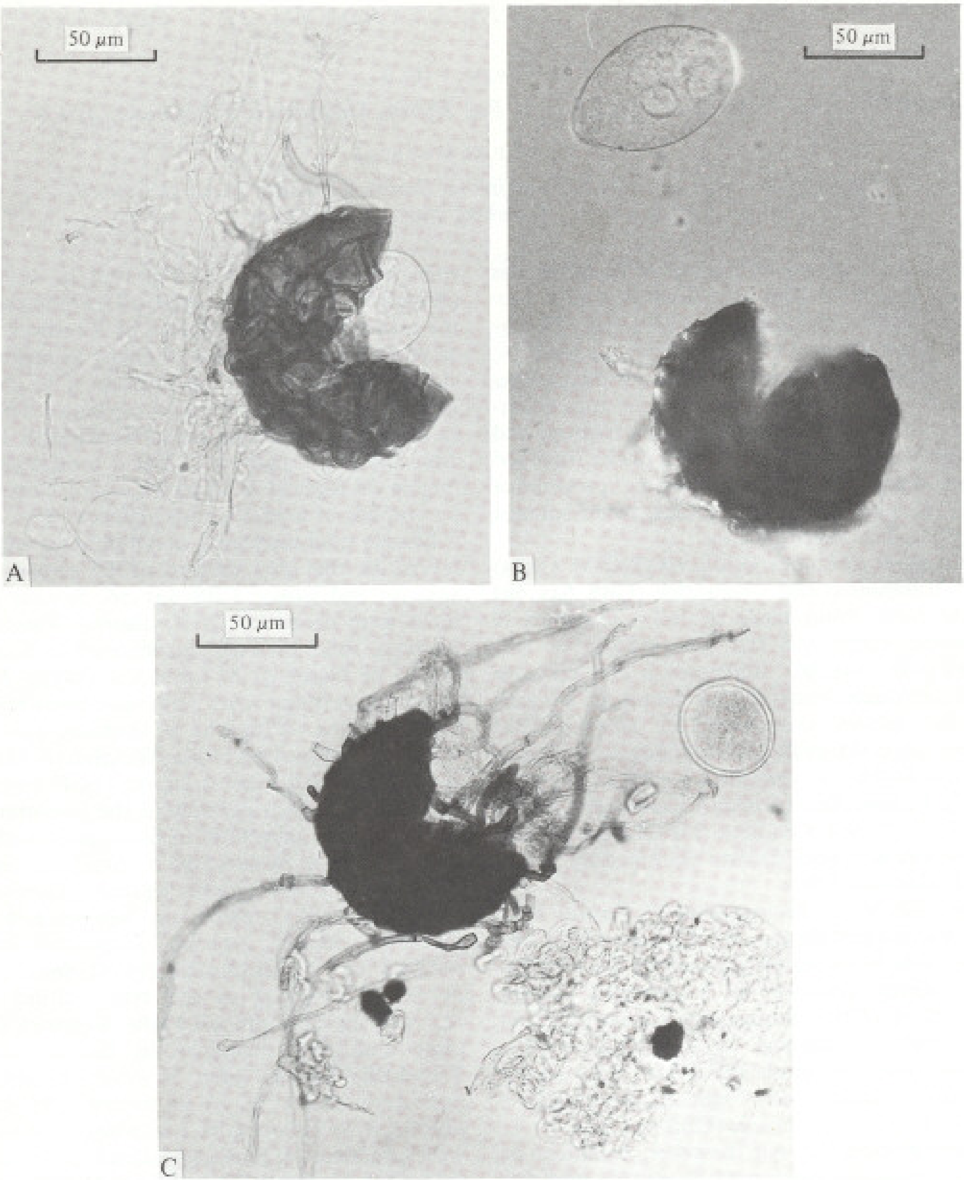

Fig. 1. Cleistothecia of *Sphaerotheca fuliginea*. (A) On cucumber; (B) on squash: note ellipsoidal ascus and ascospores; (C) on squash: note spherical ascus and dark myceloid appendages.

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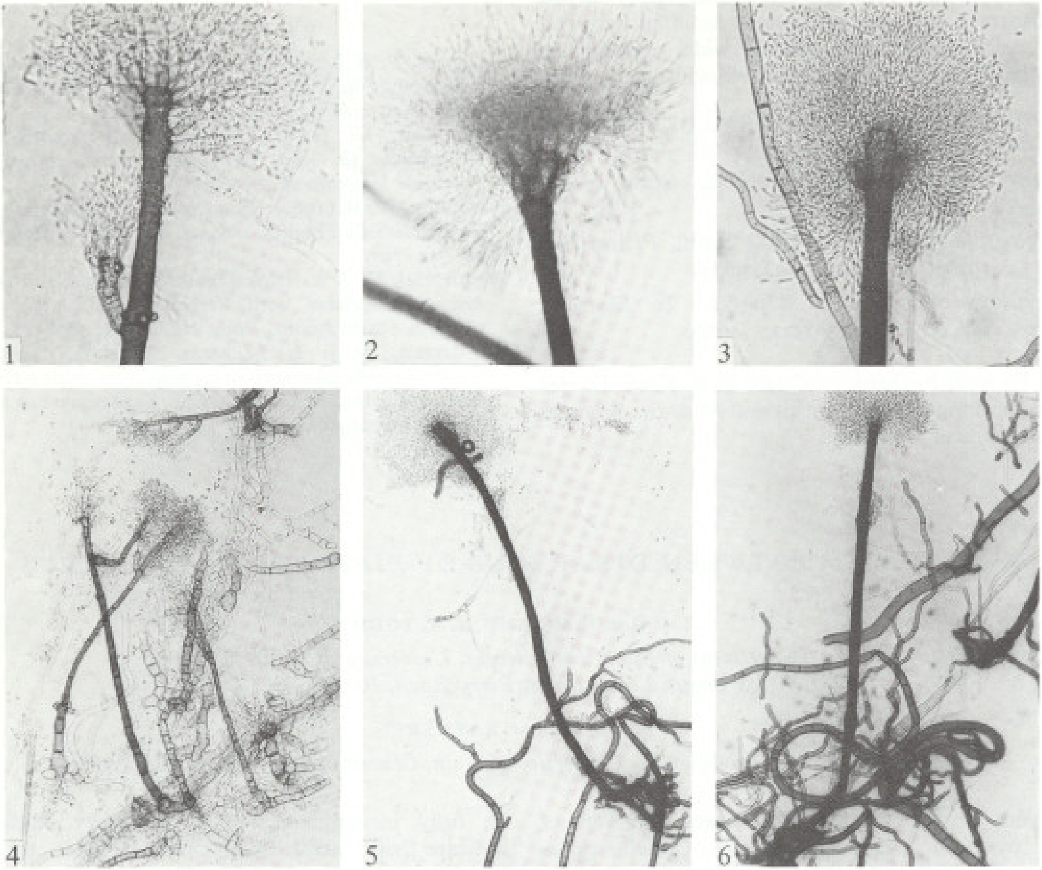

Figs. 1–6. Comparison of sporogenous apparatus, conidiophores and mycelium of *Verticicladiella serpens* type culture, CBS 141.36, *V. serpens* isolate CBS 641.76 and *V. alacris* type culture, PREM 45483.

Fig. 1. *V. serpens* CBS 141.36 with openly constructed sporogenous apparatus. × 800.

Fig. 2. *V. serpens* CBS 641.76 sporogenous apparatus with central primary metula. × 800.

Fig. 3. *V. alacris* sporogenous apparatus with central primary metula. × 800.

Fig. 4. *V. serpens* CBS 141.36 mycelium and branched conidiophore. × 280.

Fig. 5. *V. serpens* CBS 641.76 serpentine mycelium and unbranched conidiophore. × 280.

Fig. 6. *V. alacris* serpentine mycelium and unbranched conidiophore. × 300.

The serpentine mycelium in *V. serpens* is therefore considered to be unique to this species and its chief distinguishing character.

Temperature requirements and growth rate are important distinguishing characteristics of *V. alacris*, *V. procera* and *V. wageneri* (Wingfield & Marasas, 1980). Growth temperatures of the *V. serpens* type culture (CBS 141.36) and isolate CBS 641.76 on 1% malt extract agar (Wingfield & Marasas, 1980), were similar to those of *V. alacris*. Growth rates varied, but were rapid, as in *V. alacris*.

The present observations have led us to conclude that *V. alacris* is a synonym of *V. serpens* and has the following distinguishing characteristics: a dark serpentine mycelium; a sporogenous apparatus with a prominent primary central metula surrounded by verticils of lateral metulae which

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may appear as branches on the conidiophore in old cultures; simple micronematous conidiophores and a rapid growth rate over a wide temperature range. We thus propose the following synonymy.

VERTICICLADIELLA SERPENS (Goid.) Kendrick, *Can. J. Bot.* **40**: 781 (1962).

Scopularia serpens Goid., *Boll. Staz. Patol. Vegetale* **16**: 42 (1936).

Leptographium serpens (Goid.) Siem., *Planta Pol.* **7**: 34 (1939), fide Kendrick (1962).

Verticicladiella alacris Wingfield & Marasas, *Trans. Br. Mycol. Soc.* **75**:22 (1980).

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REFERENCES

GAMBOGI, P. & LORENZINI, G. (1977). Conidiophore morphology in *Verticicladiella serpens. Transactions of the British Mycological Society* **69**, 217–223.

GOIDANICH, G. (1936). Il genere di Ascomiceti *Grosmannia* G. Goid. *Bollettino della Stazione di Patologia Vegetale* **16**, 26–60.

KENDRICK, W. B. (1962). The *Leptographium* complex. *Verticicladiella* Hughes. *Canadian Journal of Botany* **40**, 771–797.

WINGFIELD, M. J. & KNOX-DAVIES, P. S. (1980). Root disease, associated with *Verticicladiella alacris*, of pines in South Africa. *Plant Disease* **64**, 569–571.

WINGFIELD, M. J. & MARASAS, W. F. O. (1980). *Verticicladiella alacris* sp.nov., associated with a root disease of pines in South Africa. *Transactions of the British Mycological Society* **75**, 21–28.

ANTAGONISM BETWEEN DIKARYONS OF *PIPTOPORUS BETULINUS*

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Recent reports indicate that adjacent dikaryons of the wood-decaying basidiomycete, *Coriolus versicolor* (L. ex Fr.) Quél., are separated genetically and physiologically within the natural substrate by intraspecific antagonism (Rayner & Todd, 1977; Todd & Rayner, 1978). This individualistic behaviour (Todd & Rayner, 1980) is in apparent contrast to the model proposed by Burnett & Partington (1957) wherein a number of dikaryons of *C. versicolor* within a decayed log were said to act physiologically and ecologically as a unit, although genetically a mosaic. Work in these laboratories has now been extended to other fungi, including *Piptoporus betulinus* (Bull. ex Fr.) Karst., which was also cited in support of the above hypothesis (Burnett & Partington, 1957). In this paper we summarize preliminary findings made with this fungus.

P. betulinus has unifactorial incompatibility, with clamp connexions, and is apparently confined to the wood of *Betula* spp., in which it causes a brown rot. It occurs throughout the North Temperate zone wherever birch is found. The existence of geographical races within *P. betulinus* has yet to be fully investigated, but preliminary studies indicate that Finnish isolates may be inter-sterile with British strains, although members of the British population as a whole are completely inter-fertile (Adams, Rayner & Todd, unpubl.; Saunders, 1956).

When natural populations of *P. betulinus* from birch are investigated by incubating serial sections of infected wood, decay columns separated by narrow zones of relatively undecayed wood are immediately obvious (Fig. 1). Such 'zone lines' lack the dark pigmentation characteristic of wood decayed by *C. versicolor*. Isolates from different positions within any one column were found to be dikaryotic and to interact without antagonism when paired in culture, but isolates from different decay columns were strongly antagonistic (Fig. 2).

P. betulinus fruits readily in culture, so that we were able to show that all isolates from the same decay column contained identical mating-type factors, indicating that each column is occupied by one dikaryon. The monokaryotic progeny of adjacent columns differed for at least one mating-type factor, but were sexually inter-fertile despite

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